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ENGINEERING'S PART IN THE DEVELOPMENT OF CIVILIZATION[1]

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SINCE the effects of engineering run all through living conditions, our topic is one of great importance to engineers and to engineering education. It is therefore appropriate for to-day's conference to be held here under the patronage of an important college of engineering and an organized society of engineers. The sub-topic ("The Social Significance of Engineering") which was under discussion this afternoon is a broad and pervasive one which means the import of engineering to society. The sub-topic also includes various others by implication. For example, it includes the social influence of engineering, which means the effect through the senses which engineering exerts on society; it includes the social implications of engineering, which means the intimate connections which relate engineering to social organization and social interrelations; and it also includes, among other things, the status or position of engineering as an entity with respect to society-organization as an entity. This evening I will go even more broadly into social relations and deal with the tripartite interrelations of engineering, social organization and civilization.

It is proper to here comment that true civilization grows as a consequence of community contacts among human beings, and intimate community contacts are (broadly speaking) made possible by and are dependent on the fruits of engineering. Such fruits became vaguely manifest many thousands of years ago and have steadily ripened and increased in scope and variety, through those thousands of years, down to the

[1] Evening address delivered as part of Symposium on "The Engineer's Place in Modern Civilization," held at Lehigh University on October 26, 1938, under the joint direction of the University and the Engineers' Club of the Lehigh Valley.

present time. Further ripening and variety-increases apparently will go on through future ages. I can not here go into the demonstration of the fundamental and continuous relations existing between social organization and engineering. I will refer those who may be interested to trace the growth of these influences to my six North Carolina lectures on "Engineering's Part in the Development of Civilization," which the American Society of Mechanical Engineers has thought worthy of publication, lecture by lecture, as a serial in its monthly magazine called *Mechanical Engineering*. This publishing began with the July issue and ends with the December issue of this year. In those lectures I have shown that community life was made possible by engineering; that some degree of civilization (which rests on principles of ethics and codes of morals) is a necessary accompaniment of community life; and, as a consequence, engineering is an inseparable companion of civilization. The increased responsibility for mutual sympathy and mutual welfare laid on individuals and on communities by the doctrines of the Christian religion have increased for engineering its opportunities to serve and its responsibilities.

The mental picture of the outcome of engineering usually held by human beings in the civilized world is of steam engines and what they have done for us; steam railroads; steam ships; electric telegraphs ("What hath God wrought!"); telephones; automobiles and hard-surfaced roads; radio sets and broadcasting stations; great structures like tall buildings, bridges, canals, harbors and irrigation works; potable water supplies and sewerage; manufacturing plants; manufactured products; and similar physical evidences. But these are only emblems, which are at the surface to-day. These are instrumentalities of engineering which have social significance, but it is inadequate, even superficial, to rest our attention with them.

To understand truly the social significance of engineering and the part that engineering has played in the development of civilization we must go deeper into the problems of society and the moulding influences of engineering thereon. It is necessary to begin with the conditions of the earliest village life, which originated in prehistoric times but which have left their records in the development of community life and civilization. We can picture these conditions from artifacts and other remains that have come down to us. It was through village life that civilization began, and through engineering that village life became possible. The single family or small group, living in a more or less roaming and precarious stage, had no civilization; but village life led to community of interests from which sprang the development of ethical principles and codes of morals that are the basis of civilization. It was thus that civilization germinated out of social organization.

Having germinated, it expanded over the world along with the movements of peoples, as sailing and rowing ships and maritime commerce grew up, and as extending trails and roads made some land commerce possible. Man seems to have been a natural trader in commerce after his gregarious period had arrived. The foundation development of civilization required a growing state of material and social well-being among men, with which there became associated a sympathetic mutual interest between individuals, and by individuals for the community welfare, in villages. It is the community of interests, which arises from integration of groups of people, that develops the qualities which characterize civilization; and conditions for living which make decent village life possible depend on engineering. Conscience and morals arise out of the social contacts in the family, clan and community, and civilization germinated in the community. Thus engineering was a frontier influence on civilization and social relations and it has been expanding that influence ever since.

The influences of metallurgy, of other engineering inventions, of agriculture, of domestication of animals, of written language became of great force among the early peoples; and community concentration became greater. Aided by engineering factors, trade between communities grew up and caused further extension of human contacts which depend for their amity on ethics and morals. Tools and simple weapons are evidences of artisanship, as also are crude pottery, weaving, simple agriculture and some domestication of animals. But the trail of rudimentary-structures, foresighted judgment regarding desirable village-locations and planned metallurgy, which trail was already trodden by some communities at the dawn of history, is the pathway of engineering—that is, it is the trail of the use of intellectual processes to bring together and combine the physical elements known to artisanship or science into a coordinated unity (such as a structure or process) for the convenience of man.

Add complex machines to these other engineering features, as is ultimately done in engineering, and we step far along in the possibilities for social relations. At the dawn of history man had come to the stage when security of life and livelihood could be sought after with some expectation of success for the most powerful few. Each step forward in the progress of engineering invention which contributed to the security of life and property for early men gave further impetus to the tendency toward community living, and this led to further emphasis also on ethical relations between man and man and tribe and tribe, and to furthering security of life and livelihood for man. In this connection the

importance of the ethical relations is to be remembered. Power to control men's life and property without restraint gives power to control their subsistence, and this is equivalent to power over their will. Out of this condition most of the autocrats and dictators of the world have made their hold secure. Let us beware.

Civilization connotes harmonious cooperation of many human beings and also mutually sympathetic, helpful and elevated relationships. For early men, this civilization (such as there was) went hand-in-hand with the crudely growing engineering arts. This was because the engineering arts enabled groups of people to become closely associated for the purpose of securing their safety of life and ease of living without sacrificing either existing conveniences or major comforts, as far as conveniences and comforts were then available. The group association of people proved the need of rules and customs of the nature of ethics and morals and a practical application of those rules to life. Generation after generation, with hesitations, recessions and recoveries, somewhere in the world further steps in engineering improvements have been accomplished, with accompanying greater human intimacy and morality. The relations disclosed in our day show that there is still far to go before the goal is reached. Acceleration of the progress is desirable, but all records of experience show that incautious haste in reform measures is a fruitful cause of confusion and that it actually tends to delay the pace of progress in its major ways. It would be well for some of our "brain trusters" and "new dealers" to take these precedents in mind and restrain their impatience lest they bring us to disaster through egoistic lack of deliberation.

Each step forward in the progress of invention looking toward security of life and property for early man gave further impetus to the tendency toward community living, and this further forced a growing respect for simple mutual interests. However, it was only after the stimulus for making inventions had resulted in an easier life with regard to life-security, food and shelter, and also had released to individuals more time for cultivating physical ease, that growing ethical relations between man and man and tribe and tribe became strongly evident, and community living became smoother. The early aims of each human being seem to have included security (*i.e.*, safety for life and limb, sufficiency of food, adequacy of shelter from the elements) for self and family, such as characterize the objectives of most mammalian animals. Then man gradually came to desire the permanent establishment of health, recreation and contentment (or perhaps the correct word would be happiness) as part of his "place in the sun."

At the present period of our nation, our people are overdoing the shout for government supported "security" maintained for individuals without aid of their own contributions accompanied by sweat of the face. Nevertheless, reasonable security of life, livelihood, health and happiness is the stuff out of which civilization is made. Man has sought and still insistently seeks security of life with its concomitants, and also the greatest degree of convenience and comfort which may be derived from any given expenditure of energy.

When reflecting on this, we must remember that, as Sancho Panza says, "Good fare alleviates care." Engineering plays a strong part in meeting fundamental human aspirations. It is a human and intellectual affair. It deals with forces and materials provided by nature, and adapts them to human service for the satisfaction of human needs and aspirations as they are felt in each particular period, and in our period all commerce depends deeply on engineering. Gathering of raw materials, manufacturing, transportation, storage and even the handling of goods have become the children of engineering. Even farming (at least in America) has become permeated with the effects of engineering.

Moreover, as engineering achievements extend, the process of satisfying aspirations and needs stimulates human society (as individuals and as groups) to formulate additional aspirations, picture additional needs and claim their fulfilment. One's needs seem to increase along with one's opportunities, and failure to immediately satisfy the seeming needs, to the full, causes disappointment that seems like suffering. To safely qualify under such conditions, engineering must live under the guiding influence of the social philosophy of the successive periods, while always controlled by the restraints which characterize exact science.

This combination is a lively cause of friction. The stimulus of their aspirations and felt needs leads most human beings to press for an immediate fulfilment. This ambition often is encouraged and supported by theorists who have failed to observe that too great rapidity of change in social organization leads to ultimate harm instead of permanent satisfactions. Life in the aggregate is a composite of multifold relations and always has been. Revolutionary changes of social organizations usually leave a train of wreckage and hardship for all, including those most in need of improved conditions. Sound judgment demands that changes be made considerately, gradually and with careful forethought. Thoughtful consideration is the way of wisdom. The records of history make these relations plain, but time does not permit the exposition of those records here. During the past 150 years our engineering improvements which are competent to afford convenience and comfort for all people have come rapidly forward, but our legislative acumen and foresight have not advanced in equal degree in the same 150 years. Alexander Hamilton wrote in the *Federalist* 150 years

ago that, "Necessity, especially in politics, often occasions false hopes, false reasoning, and a system of measures correspondingly erroneous." Hamilton's pregnant cautionary words still carry a significance equal to the significance which they held in his life-time.

As citizens, we of this nation are proud of the education from which we profit. There is considerable justification for the pride, but instances arise which show that the results of education have not fully permeated among the citizenship even for the most elemental affairs of life. I will cite an extraordinary illustration which was disclosed to me as a bona-fide occurrence. A married woman from low-income circles appeared almost annually at a hospital for delivery of a child until the family was an even dozen. Again she came, and (as she was leaving this time) the attending physician said, "I presume we will see you again next year." "No, ye'll not," said she, "me husband and me has just learned what makes them." This is quite on a level with the ignorance among some of the primitive aboriginal tribes of Australia and elsewhere, of which the natives "do not recognize sexual intercourse as a cause of conception" and give other specific causes.

If we still have in our midst such ignorance of fundamental biological phenomena which arise out of our personal intimacies, is it reasonable to expect a general sound knowledge of the less concrete phenomena of economics and society? Even our most expert citizens confess shortness in assurance regarding the latter phenomena. Therefore, the acute frictions (such as arise, for example, in the industries as a consequence of the close intimacies brought about so rapidly by the engineering inventions of the last two centuries) are likely to be the unhappy outcome of ignorance and prejudice. Such being the case, they are causes calling for sympathetic, man-to-man adjustment with such mutual forbearance as can be marshalled. The old-time destructive violence guided by violent minds, which was associated with industrial combats of my youth, is now outmoded in the minds of many of our citizens and must be brought to condemnation by all. Progress that is being made is the result of recognizing from all sides the advantages of man-to-man negotiation. Education which tends to the diffusion of truth, and thereby eradicates ignorance and prejudice, may come to the rescue.

A much fuller recourse by industries to plain, factual, impartial expositions to the public of their internal organizations, their external relations and their difficulties, widely circulated by means of advertisements, in my opinion, would help. Some industries have successfully utilized this process, although considerable advertising apparently intended for the purpose is so general that it is publicly accepted only as propaganda and has little influence. In many instances local advertising is excellent, but generally-flung advertising from the same sources often is superficial and is received by the public only as propaganda. Some writers of advertisements seem to give more weight to "catchy" wording than to accuracy of content. Many important industries limit their statements of factual character to periodical formal reports to owners (stockholders) and bankers, and these reports receive little general, public attention even when they are reasonably complete. Employes, customers and owners of industry and their families make up a goodly proportion of our population, and we may add to the three named categories those other members of the population who are often denominated the "public at large" as also parties in intellectual interest regarding industrial and other corporations. These should be catered to.

The factual and disclosing information which might enlarge knowledge and allay prejudice in this field is not readily available from books, monographs and magazine articles. Fuller measures of factual disclosure are needed so that honest and adequate information may be before the public in general. When we have in use in this country some nine tons of steel per capita of all our population and this figure grows faster than the population (I use estimated figures published by the American Iron and Steel Institute) we all are interested in the processes related to this important background of many affairs in our daily life.[2] I infer no criticism of the advertising displayed by the steel industry. Few industries do so much or so well, but I wonder whether the steel industry might not serve the public (and also the stockholders) by doing more. Constantly applied, careful efforts at making facts known throughout the nation, in my opinion, is a shining means for forestalling the effects of ignorance and prejudice and for thereby ameliorating a sore spot in the social relations occurring as a consequence of engineering. An uninformed public usually is influenced by predetermined notions and prejudices; but the American public, when it feels itself rightfully informed and has had time to reflect on its knowledge, usually proves itself to be fairminded. We are likely to forget that success in impressing the intelligence of great masses of people requires that clear, factual expositions shall be repeated again and again; although demagogic or inaccurate eloquence, once or twice expressed in fluent nonsense trickling from the speaker's tongue, may emotionally carry the same people into great error.

The inseparable relation of engineering to civilized society and to effective social adjustment is seldom given enlightened attention, and much of the fault of

[2] Since the delivery of this address, competent critics have expressed the opinion that the figure of nine tons is too high; but in any event the total steel in actual use per capita is an important figure relating to our mode of life.

some ardently preached social doctrines is due to popular misunderstanding of the true sources for enlarging material wealth. It is an unavoidable reality of nature that increases of permanent wealth are gained fundamentally only from what is grown on the surface of the earth, and taken from within the earth, from the waters of the earth or from the air surrounding the earth; and that the processes of securing the wealth require muscular and mechanical power directed by the minds of men. For the populations to cease to work would mean that they would cease to live. We must keep industrious with minds and muscles or we can not live in the comfort and plenty which is an ideal among western nations—evolved to different degrees in different nations but existing in all. It is important also to remember that joy in useful accomplishment, by the individuals composing a society, is essential to the realization of the best social adjustment. How to achieve the desired end of inciting joy in accomplishment is indeed a problem; but the engineering of machinery to more and more lift long hours of muscular labor from the shoulders of men, associated with spreading mental effort more generally among men, is a promising path to the solution. Moreover, an increase of leisure which is so ardently desired by most people can only be accomplished by substituting in all practicable situations mechanical power for muscular power, by means of inventions which make the substitutions possible at moderate capital expense so that an extra margin of saving is produced, from which all concerned may profit. The phrase "all concerned" includes workers and customers as well as owners. It here is to be noted that scientific discoveries and engineering inventions which lessen the cost of useful processed products or which provide useful new products usually increase the rate of the production of new wealth.

Engineering is a process of planning, organizing and executing work concerned with directing the forces of nature to the service of mankind; while the word civilization connotes well-established, sympathetic ethical and moral relationships in society. The latter relationships develop only where considerable numbers of people work together for common ends, and means of community living or other community contacts are provided by engineering for the grouping of the people in harmonious unity and providing for their material needs. This must not be mistaken for communism. It is quite the contrary. Full civilization connotes harmonious well-being based on mutual sympathy associated with ethical and moral relations in society, while democratic independence of the individual is maintained to the limit of conscience expressed without external restraint. Communism, on the contrary, suppresses individual independence; and it may destroy mutually sympathetic relations while providing for livelihood in common.

The human mind, in mass, is very slow to change in character; and stable improvements of mutual relations can not be rushed to success by the vaguely applied efforts of professional reformers or dilettantes in social affairs. Such improvements may only be successfully produced slowly, in association with sounder-growing mass-thought regarding living affairs in both material and ethical relationships; and here the influence of engineering in showing the ways to material betterment is of primary importance. Following in the wake of material betterment and increased leisure, intellectual improvement also usually comes as an ultimate contribution to social welfare.

By living in ready contact with each other, we have come to recognize (in at least a glimmering degree) that the best living is when life is put to intelligent use in mutual advantage. We yet have much to learn before this is realized at a reasonable level, but ultimately we will be able to mould our engineering so as to achieve the wished-for ends. Sound progress connotes aid in bringing forward those persons who need aid and are willing to cooperate in the effort at aid. It also connotes unrestrained encouragement of the practices of those who are competently proceeding with ethical consideration along their individually chosen creative courses. Unless American politicians can be brought again to follow such tenets, instead of following the hysterical urgings of professional reformers, we will be justified in persistent pessimism regarding human affairs in this nation.

One who studies with concentration the changes which have occurred in the living conditions of the populations of European nations during the last two hundred years, or of our people during the existence of our own nation, must be impressed by the great change for the great proportion of the people from sordidness and insecurity of life and livelihood to relative security, comfort and happiness. In these days, certain of our fellow citizens point to Sweden as a notable example of economic and social welfare. In a relative way, they are right; for Sweden has come forward in an admirable manner out of an age of sordid living and misery for most of its people. Means for ready and economical transportation, means for quick transmission of intelligence, means for generating and transmitting power, means for sanitation and other great engineering achievements have changed the face of the people. The sordid and miserable have been raised and the disparities in security and happiness which formerly existed between the few and the many have been notably lessened by improving the lot of those formerly miserable.

The same miracle has occurred to the people of the

British Isles, France and other nations. The changes have been gradual but effectual, and they continue their course. The sound results have come from utilizing cautiously applied measures for lifting the many. Where tearing down the superior economic and security status of the few has been practiced, it has always left in its train a legacy of disadvantages and misfortunes that affected people in all conditions of living.

Our experiences have not been without analogy to the experiences of European peoples and we may well examine the sign boards of their history. We started later, with a pioneering people whose active utilization of their restless intelligence in a favorable setting did much for them. Our utilization of engineering achievements has been correspondingly active, and engineering invention has gone on at a high pace. The living conditions for our healthy and industrious citizens have been at a high level compared with the corresponding citizens of Europe. If one third of our citizens are inadequately provided with food, clothing and shelter (as viewed from our accepted standard of living), as has been alleged, I presume with truth, they are among those who need betterment and should be shown practical means by which they can come to betterment. But the precedents show that no general gain is secured by pulling down some with the object of raising others, nor by over-fast efforts at general reforms such as have been pressed forward by our professional reformers and some of our politicians during the past several years. Our social changes, if they are to be truly serviceable, must proceed at the pace which characterizes natural improvement of thought in an environment of encouragement, and they must not be unethical, or our results in the end are likely to be adverse for those who should be helped instead of affording the betterment which is desired.

Politics in this country are seldom free from false slogans of which the unsoundness would be exposed by exacting analysis. We now are suffering from the effects of various partially or wholly false slogans that relate to the fields of government, engineering, education and security, which have been formulated to satisfy the supposed slogan-hunger of the majority of mankind. For illustration, the false doctrine that civilization is decaying has been asserted again and again during the period from several thousand years ago to the present time and people still volunteer their ideas for saving civilization. The answer is plainly spread before us. If decay had in fact been going on over this long period, there would be mighty little civilization left with us to-day—instead of which we have in the best parts of the western world a civilization which is superior, in the sense of being more comprehensively helpful to man, than that existing anywhere in any of the preceding centuries. This statement rings true when it is tested by comparison of to-day's conditions of the great mass of people with earlier conditions, whether two generations, two centuries or two thousand years back.

If moral relations and security of life mean anything in happiness, as most of us believe, there is more happiness in this country to-day than heretofore in any country of great population. There certainly are more comforts in life than in any earlier time, and more leisure for most people, mostly brought about by engineering applications of science. And even from this level, progress continues in a clear pace. Trying to over-accelerate that pace by poorly conceived political nostrums harms instead of helps. Efforts put forth to save civilization are only folly and are not needed. What are needed are efforts to deepen and enrich the spirit of sympathetic understanding between men, so as to better the conditions for negotiating the amelioration of those differences which may injuriously arise because of our more constant and intimate mutual contacts.

Engineering processes and engineering devices have been (and are being) abused by use in warfare, but not by choice of the leading minds of the engineering profession. The profession, with few exceptions, stands on the conviction that war is tragic, expensive, inefficient and unnecessary. However, as world affairs display themselves, we must be prepared in an organized way as a nation to stand against aggression from without in case aggression should arise in spite of friendly negotiations planned to prevent forcible action. Convince man that war will not ultimately result in greater wealth, security and stability for himself and his nation and the tendency toward organized war will be weakened. Especially will this be achieved if other sufficient routes are kept open on which men's love of risk and adventure can be fully expended, while the paths to selfish profit during war are closed. It lies with us to hold so steadfastly to the duty of more fully developing the peaceful occupations of agriculture, industry and commerce that the minds of our people may be turned away from contemplating aggressive expansion and warfare. Engineering favorably influences all those peaceful occupations, and we engineers have an obligation to ourselves and our fellow citizens to encourage the highest practicable development of these ethical aspects of engineering.

That is the attitude of engineering in this aspect of its social relations. The defects in human relations which arise in local, national and international affairs are due neither to faults in the fundamental ideal of a complete civilization, nor to engineering which has set up and continues to maintain the stage for a possible realization of that ideal. A grave responsibility rests

on critics of our status, who are failing in the call for agitation and education of the public to a realization of the relative fitness of things. This is a personal and group matter to achieve, and it can not be achieved by partisanship or foul play.

Much has been accomplished in the long-time development of civilization. Much is yet to be accomplished. The accomplishment can not be secured in any nation by legislation alone. The solution can be obtained by joint use of two paths. One of these leads to continued emphasis on sympathetic negotiations between man and man, or group and group, before going to extremes. Much progress for our country has been made in this path during the past half century. Such progress has been notable in our engineering industries, but nevertheless it is yet insufficient, and more sympathetic relations must be fostered. However perfect a coin may appear on one face, if it is suffering from corrosion on the other face it is defective and needs reminting. Social reminting in an engineering world with its democratic qualities, however, requires a depth of consideration and range of cautious adjustments which immeasurably transcend the requirements for the machine-reminting of coins.

The other path leads to the joint problem of education in engineering and political economy which is now crying for solution in order that the social problems may be smoothed and society may be aided to make progress in the best sense. Our national needs are, on the one side, a moratorium on loosely drawn legislation, careful simplification of laws which we have, and primarily emphasized efforts to make ethical principles a guide in both the observation and the administration of statute-law. Abstract justice is an ideal, but enforcement of law according to ethical principles can be made a very practical thing.

On the other side, our national needs include a careful nurturing of the results of scientific research and discovery in the fields of natural science and of so-called social science, which may stimulate engineering invention and engineering practice out of which still further improved living conditions may arise. Many endowments for research in natural science and in economics and sociology exist, and our need is for an endowment to promote the study (including research and exposition) of the joint relations of engineering and political economy, having for its purpose to establish an understanding of the most helpful relations which may be built up for a prosperous social welfare. This is a need indeed, and a donor can make the nation his never-ending debtor by establishing an endowment to this end.

OBITUARY

EDWARD SAPIR

THE death of Edward Sapir on February 4, 1939, when in mid-career, marks a loss of leadership in anthropology and linguistics. It will be difficult to find another who possesses his distinctive assets of originality, profundity and insight.

Born in Lauenburg, Pomerania (January 26, 1884), he was brought to the United States as a little child. His formal training was at Columbia University: A.B., 1904; A.M., 1905; Ph.D. in 1909 under Franz Boas. His initial professional appointments were as research assistant, University of California (1907–08) and instructor in anthropology, University of Pennsylvania (1909–10). During this period, he was concerned with analysis of several western Indian languages (Yana, Wishram, Takelma, Southern Paiute).

As chief of the division of anthropology, Geological Survey of Canada (1910–25), his own research was primarily with the language and culture of several northern Indian groups: Nootka and Athapascan. These remained preoccupations through his life, the latter especially giving rise to an extended comparative study of the far-flung Athapascan stock and its Sinitic connections. It was at this time that he developed an interest in psychological and psychoanalytic insights into linguistic and cultural behavior.

In 1925 Dr. Sapir began a systematic teaching career: assistant professor of anthropology (1925–27), professor of anthropology and general linguistics (1927–31) at the University of Chicago; Sterling professor of anthropology and linguistics at Yale University (1931–39). His enthusiasms fired a group of highly competent linguistic students who will, without question, give continuity to his views in the next generation.

He received manifestly deserved academic recognition: honorary Sc.D. from Columbia, 1929; membership in National Academy of Sciences, American Academy of Arts and Sciences, American Philosophical Society, Société des Américanistes de Paris, Reale Accademia della Scienze (Bologna); and was elected president of the Linguistic Society of America (1933) and the American Anthropological Association (1938).

His ethnographic studies were, for the most part, incidental products of his linguistic work. But this gave them a distinctive quality, namely, a constant illumination from linguistic insights. This approach marks his principal contribution to ethnological method, "Time Perspective in Aboriginal American Culture" (1916). His published ethnographic reports are few and brief, but a deftness and incisiveness make them models of description. His two little papers on

the Takelma of Oregon, for example, are marvels of succinct presentation and put to shame many a more pretentious monograph. It is therefore regrettable that he left incomplete his magnificent collection of materials on Nootka, Yana and Hupa.

Dr. Sapir's major published contribution, however, lies in the field of language. His control of the perfected techniques of Indo-European and Semitic philology was extended into the realm of primitive languages. Lexical and grammatical contributions, ranging from Hebrew and Tocharian to American Indian Uto-Aztecan, Hokan, Athapascan and Wakashan, attest his extraordinary fertility. The soundness of these analyses can not be challenged. Beyond this, though fully recognizing independent developments, his emphasis on "drift"—the idea that languages differentiated from a common base will show parallel modifications—led him to suggest genetic connection in families previously regarded as distinct.

The more unique contribution lay, not in structural nor historical phases, but in language as a psychologic-symbolic phenomenon. In the first place, he offered in "Language" (1921) a new approach of broad philosophic sweep. Pointing out that the traditional classification of languages relates properly only to their techniques, he emphasized the more fundamental characterizations of conceptual types and degrees of synthesis. The primary concern is with basic concepts, their radical or relational, pure or concrete nature, and the mechanisms for their expression. Essentially, this is emphasis on language as thought rather than as form.

His studies of the interrelations of psychiatry and culture are closely allied to this. Here he was concerned that psychiatry and psychoanalysis should profit from a study of variant cultural matrices and that cultural behavior as mechanism for thought and living should be understood in terms of psychological experience. When chairman of the Division of Anthropology and Psychology, National Research Council (1934–35), he had opportunity to lay the groundwork for coordinated studies along these lines, which may be expected to bear future fruit.

His most striking personal characteristics were a crystalline quality of thought and speech and an ever-present kindliness. The artistry of his effortless verbal performances, his articulateness, was a delight. It is no accident that half his writings are groups of poems, literary and musical criticism, showing the same heightened sensibility to nuances of sound and meaning, the same intuitions, that fertilized his linguistic and psychiatric work.

No life can be long enough to accomplish the program he set for himself, but we can only regret that his proved so brief.

LESLIE SPIER

NEW HAVEN, CONN.

EDMUND CECIL SHOREY
1865–1939

DR. EDMUND C. SHOREY, retired senior biochemist of the Bureau of Plant Industry, U. S. Department of Agriculture, died on January 30 at Emergency Hospital, Washington, D. C., after a protracted illness. He served, since retiring in 1935, as a collaborator with the Division of Soil Fertility Investigations, where formerly he was in charge of biochemical investigations of soils and fertilizers.

Dr. Shorey, born on March 5, 1865, in Lanark County, Ontario, Canada, was graduated from Queens University, Kingston, Ontario, with a B.A. degree in 1886, an M.A. degree in 1887, a D.Sc. degree in 1896 and gold and silver medals in chemistry and natural science, respectively.

His professional career began as chemist for the Kohala Sugar Company of Hawaii in 1893. Upon annexation of Hawaii in 1899, he became food commissioner for the territory and served for four years. In 1903, Dr. Shorey entered the field that later held his major attention, when he joined the Hawaii Agricultural Experiment Station as chemist. In 1907 he was transferred to the Bureau of Soils in Washington, D. C., and was associated with the Division of Fertility Investigations until 1915, when he was placed in charge of the Division of Chemical Investigations. He left the government service in 1918 to engage in industrial chemical research, but returned to the Division of Soil Fertility Investigations in 1922 as biochemist, becoming senior biochemist in 1928.

Dr. Shorey's major interest was in the organic constituents of soils and the nature of humus. His outstanding research in this field gained him an international reputation. His intense interest in this research was maintained until the last, as evidenced by the publication last March of his work upon the presence of allantoin in several soils. He was actively engaged in similar work up to his final illness.

Dr. Shorey was a fellow of the American Association for the Advancement of Science, a member of the American Chemical Society for more than forty years, a member of the Society of Biological Chemists, a member of the Washington Academy of Sciences and a fellow of the American Institute of Chemists. His home at the time of his death was in Falls Church, Va.

OSWALD SCHREINER

BUREAU OF PLANT INDUSTRY

RECENT DEATHS

WILLIAM H. COLLINS, director of the Observatory of Haverford College from 1892 to 1904 and prefect of the college from 1897 to 1919, died on March 11, aged seventy-nine years.

WILLARD DELL BIGELOW, since 1913 director of the research laboratory of the National Canners Association, died on March 6 at the age of seventy-two years.

He was a member of the Bureau of Chemistry of the U. S. Department of Agriculture from 1892 to 1913, the last ten years as assistant chief.

DR. FERDINAND VON LINDEMANN, professor of mathematics emeritus of the University of Munich, died on March 7 in his eighty-seventh year.

SCIENTIFIC EVENTS

WORK OF THE SCHOOL OF TROPICAL MEDICINE AT THE UNIVERSITY OF PUERTO RICO

THE School of Tropical Medicine of the University of Puerto Rico under the auspices of Columbia University, according to the annual report of Dr. George W. Bachman, director of the school, has completed twenty-five research projects out of fifty-eight undertaken. Current investigations include nutrition and malnutrition, parasitism, epidemiological surveys, skin and fungi studies, immunological response to infections, biological properties of various agents of disease, pathological and blood examinations and clinical work.

A survey of the health and socio-economic conditions found in the tobacco, coffee and fruit regions of Puerto Rico was carried on by the department of bacteriology in cooperation with the Puerto Rico Reconstruction Administration. The department also investigated streptococcus infection in the tropics. It has commenced a study on the incidence of pneumococcus with relation to the cultural and biological characteristics of the flora of the respiratory tract of normal Puerto Ricans.

A study of tuberculosis in tonsils was carried forward in collaboration with the Henry Phipps Institute of Philadelphia, and a study of the prevalence of abortion diseases in cattle of the Island was made in cooperation with the Bureau of Animal Industry of the U. S. Department of Agriculture. A joint investigation by the department of chemistry and the Agricultural Experiment Station was made of forage crops.

The department of medical zoology made a study of vitamin A and the part it plays in immunology to invasion by schistosomes or blood flukes. An extensive survey was conducted in several sections of the Island to find the breeding places of the sandfly.

An epidemic of black "piedra," a disease of the hair marked by small stony nodules never before reported in North America, was traced by the department of mycology and dermatology to a fungus classified as "Piedraia hortai." A parasite survey of mice, never before attempted in Puerto Rico, but facilitated during the year by quantities of rodents brought into the department of pathology, brought to light several parasites previously unrecorded in the Island, and one trematode, or fluke, hitherto considered only an Old World inhabitant. The chance finding in the laboratory of a wild brown mouse, sickly and deformed and presenting all the characteristics of the musculotaneous variety of leprosy, as seen in rats, opened a new problem of investigation on the character of spontaneous leprosy in mice. The department of pathology made a further study of the problem of internal hydrocephalus of rabbits.

Research on the medicinal properties of Puerto Rican plants is now being conducted at the University of Wisconsin by Conrado Asenjo, Jr., fellow of the Guggenheim Foundation and a member of the chemical staff of the school. Under the guidance of Professor Karl P. Link, of the University of Wisconsin, plans for a laboratory of phytochemistry are being elaborated for the continuation of this work at the school.

Reforestation of the Island of Santiago off the Eastern coast of Puerto Rico is under way in preparation for use of the island as a free range for apes. Gibbons collected for breeding purposes from the mountains near Chieng Mai, Siam, by Dr. C. R. Carpenter, of the Columbia University School of Medicine, will be transferred from the modern cages now housing them to the Island, and a field laboratory will be constructed.

Occupancy of the University Hospital in San Juan, which is being remodeled under the supervision of the Puerto Rico Reconstruction Administration, will be effected by March, 1939.

ADMISSION REQUIREMENTS IN THE COLLEGE OF ENGINEERING AT CORNELL UNIVERSITY

BEGINNING next September, a more comprehensive and closely controlled plan of selective admission will be adopted in all four schools of the College of Engineering at Cornell University, according to an announcement made by Dean S. C. Hollister. The School of Chemical Engineering has had such a system since its establishment last July, when it was decided that available facilities for instruction could accommodate only about a hundred of the more than three hundred applicants for admission to the freshman class. Increased enrolment in the Sibley School of Mechanical Engineering this year has produced another serious problem, and similar conditions are foreseen in the Schools of Civil and Electrical Engineering.

The number of applicants admitted to the several schools of the college is limited by the facilities available for adequate instruction. Since the number of applicants exceeds these limits, the Committee on Admissions in each of the schools will exercise discretion-

ary power in selecting those to be admitted. Preference will be given to those candidates whose academic preparation and personal character would indicate fitness to pursue with success the course being undertaken and who show evidence of professional promise.

The need for additional facilities has been felt for some time, and a committee of the Board of Trustees, of which Bancroft Gherardi, retired vice-president and chief engineer of the American Telephone and Telegraph Company, is chairman and Provost H. Wallace Peters is secretary, has undertaken a program to strengthen the resources of the college. Among the first objectives are a new building for the School of Chemical Engineering and a Materials and Metallurgy Laboratory, which will allow expansion of classroom and laboratory instruction, especially mechanical engineering.

It is estimated that undergraduate enrolment in the College of Engineering, even under the improved selective admission plan, will reach 1,200 next year, a figure within 300 of the maximum to be provided for when the proposed building program is completed. A statement by Dean Hollister says: "Cornell's standards in engineering education have always been high and will not be lowered. Under present conditions, our policy must be to offer the facilities we have to those students best qualified to make advantageous use of them."

THE CHEMICAL ENGINEERING LABORATORY OF THE CASE SCHOOL OF APPLIED SCIENCE

THE Chemical Engineering Laboratory of the Case School of Applied Science, which has been completed at a cost of more than $300,000 and which is the first unit of a group to be devoted to the department of chemical engineering, will be dedicated on Saturday, April 15. At a luncheon which will precede an inspection of the building, Dr. William Reed Veazey, of the Dow Chemical Company, of Midland, Mich., formerly professor of chemical engineering at the school, will be the principal speaker.

The new building, which is now in course of being occupied, provides facilities for teaching and research in physical and organic chemistry, chemical engineering and plant design and offices and research laboratories for the staff. The main unit comprises three floors and a basement; an annex of two stories adjoins this. The main building is 104 feet long and 61 feet wide; the annex has a frontage of 44 feet and a depth of 60 feet. Constructed of steel and concrete with a shale brick exterior, the building is of modern industrial type with a maximum of natural light, which is provided through a continuous run of windows along the full length of each floor.

Laboratories in the new building include those for unit operations, senior development, organic chemistry, physical chemistry, fuels, water and lubricants and chemical engineering. The latter will be located in the two-story annex, which will provide space for larger apparatus for use in distillation, absorption and evaporation. Also included are seven offices with private laboratories, an auxiliary research laboratory and three recitation rooms. Service rooms include a mechanics shop, mechanical store room, grinding room and drying room in the basement; furnace room, students' shop and balance room on the first floor; instrument room on the third floor, while in a pent house is an automatic distilled water system and ventilating fans to insure change of air in all laboratories and offices at intervals of from four to six minutes.

The building will care for approximately 40 per cent. of the space needs of the department. Until additional units are constructed, work in general chemistry, quantitative and qualitative analysis and graduate work in many fields must be continued in the 44-year-old building. The old building will continue to house the chemistry library.

The new building has been designed by Walker and Weeks, Cleveland architects, who have worked in close conjunction with Dr. Carl F. Prutton, professor of chemical engineering, and members of the faculty in this department. Construction has been in the hands of the Sam W. Emerson Company, of Cleveland.

SURVEY OF MEDICAL RESEARCH FACILITIES IN CANADA

THE Associate Committee on Medical Research of the National Research Council met in Ottawa on February 27 and 28. The committee had before it the report on the survey of medical research facilities in Canada that was carried out at the instance of the committee by its chairman, Sir Frederick Banting.

Consideration was given to the fields of medical research in which work could now be organized and a conclusion was reached that immediate attention should be given to tuberculosis and rheumatic diseases. In each of these fields projects are to be initiated in a number of institutions throughout the country where the particular investigations can be carried out with economy and advantage. The projects in these fields will be correlated by the Medical Research Committee.

In the field of cancer research the committee decided to give first attention to the continuation of work on the standardization of x-ray dosage which has been undertaken in cooperation with the National Physical Laboratory in England and the National Bureau of Standards in Washington making use of the high voltage apparatus available in the National Research Council Laboratories in Ottawa. With the increase in voltage and power of the equipments becoming available for clinical treatment in Canadian hospitals, the

information on standardization and dosage measurements to be obtained is regarded as basic.

Attention was directed to the importance of developing research in the various institutions throughout Canada so that in due course as the committee extends its work the required facilities and trained personnel may be available. To this end several assisted researches on a wide variety of subjects have been proposed, and the various medical institutions concerned are being invited to undertake this work under the auspices of the committee.

Sir Frederick Banting presided at the meeting and Major-General A. G. L. McNaughton, president of the National Research Council, and Dr. R. E. Wodehouse, deputy minister, Department of Pensions and National Health, were present as *ex-officio* members of the committee. The other members present included: Dr. Donald Mainland, professor of anatomy, Dalhousie University; Dr. J. E. Gendreau, director, Radium Institute, University of Montreal; Dr. J. B. Collip, professor of biochemistry, McGill University; Dr. A. Grant Fleming, dean of the faculty of medicine and professor of public health, McGill University; Dr. W. G. Penfield, professor of neurology and neuro-surgery, McGill University; Dr. G. H. Ettinger, professor in the department of physiology and embryology, Queen's University; Dr. T. H. Leggett, Ottawa; Dr. J. C. Paterson, director of the pathological department of the Civic Hospital, Ottawa; Dr. Duncan Graham, head of the department of medicine, University of Toronto; Professor V. E. Henderson, secretary-treasurer of the Banting Research Foundation, Toronto, and Dr. P. H. T. Thorlakson, assistant professor of surgery, University of Manitoba.

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS

DR. GEORGE W. HUNTER, III, secretary of the Union of American Biological Societies, writes that at the annual meeting of the Union of American Biological Societies in Richmond on December 28 membership in the union was voted to the newly formed National Association of Biology Teachers—an organization of those who teach secondary school biology and others with allied interests. This association was formally established on July 1, 1938, in New York, largely as the result of the activity of the Committee on the Teaching of Biological Science, of which Dr. Oscar Riddle is chairman. The association already has a membership of approximately 2,000, and has founded a journal—*The American Biology Teacher*—issues of which have appeared monthly since last October. The committee is continuing its efforts to enroll teachers of secondary-school biology in this association and to increase the value and influence of its new journal. Professional biologists everywhere can now give valuable and much needed support to this enterprise. At the Richmond meeting the union formally adopted the recommendation "That professional biologists of the United States take notice of the very recent formation of a National Association of Biology Teachers, and that they assist this new organization by submitting suitable material to its journal and otherwise by encouraging or promoting the formation of local units of the association in their own communities."

Communications may be directed to the committee representative, Professor David F. Miller, the Ohio State University, Columbus, and other correspondence should be addressed to the Secretary-Treasurer of the National Association of Biology Teachers, P. K. Houdek, Robinson, Ill.

ELECTION OF RESIDENT MEMBERS OF THE WASHINGTON ACADEMY OF SCIENCES

RESIDENT members of the Washington Academy of Sciences have recently been elected as follows:

Harry S. Bernton, practicing physician and professor of hygiene and preventive medicine, Georgetown University, in recognition of contributions in the field of protein sensitization.

Gerard Dikmans, parasitologist, Bureau of Animal Industry, in recognition of his contributions to parasitology, especially helminth parasites of ruminants.

Irvine T. Haig, principal silviculturist, U. S. Forest Service, in recognition of his contributions to forest research, particularly on the growth, yield and natural reproduction of the western white pine of the Northwest.

Elmer Higgins, chief of the Division of Scientific Inquiry, U. S. Bureau of Fisheries, in recognition of his contributions to marine biology as related to the fisheries.

Hugh Curtis McPhee, chief of the Division of Animal Husbandry, Bureau of Animal Industry, in recognition of his contributions in the field of genetics of plants and animals.

Elmer Martin Nelson, principal chemist of the Food and Drug Administration, in recognition of his researches in the field of nutrition and vitamins.

Walter Ramberg, physicist of the National Bureau of Standards, in recognition of his contributions to mechanics, in particular his researches in the mechanics of structures.

Sanford Morris Rosenthal, senior pharmacologist of the National Institute of Health, in recognition of his researches on the test for liver function, the pharmacology of arsphenamines and mercury and the chemotherapy of sulfanilamide.

Harry Waltner Titus, senior biological chemist of the Bureau of Animal Industry, in recognition of his contributions to the physiology and chemistry of nutrition, in particular the nutrition of poultry.

Everett Elmer Wehr, associate zoologist of the Bureau of Animal Industry, in recognition of his contributions to helminthology, particularly nematode parasites of birds.

DR. ALBERT EINSTEIN

THE sixtieth birthday of Dr. Albert Einstein occurred on March 14.

He said:

My birthday affords me the welcome opportunity to express my feelings of deep gratitude for the ideal working and living conditions which have been placed at my disposal in the United States. I am also very happy over the prospects of becoming an American citizen in another year. My desire to be a citizen of a free republic has always been strong and prompted me in my younger days to emigrate from Germany to Switzerland.

What distinguishes a true republic is not only the form of its government but also the deeply rooted feelings of equal justice for all and of respect for the person of every individual.

SCIENTIFIC NOTES AND NEWS

THE National School of Biological Sciences of Mexico recently opened with appropriate ceremonies a new laboratory of entomology, which is named in honor of Dr. Leland O. Howard, chief of the U. S. Bureau of Entomology from 1894 to 1927 and principal entomologist of the U. S. Department of Agriculture from 1927 to 1931, when he retired. Ambassador Josephus Daniels made an address in which he outlined Dr. Howard's career.

DR. HENRY NORRIS RUSSELL, research professor of astronomy and director of the observatory of Princeton University, and Professor A. Pictet, of Geneva, have been elected associates of the section of mathematical and physical sciences of the Royal Academy of Belgium.

PROFESSOR HARLOW SHAPLEY, director of the Harvard Observatory, has received the Bruce medal of the Astronomical Society of the Pacific in recognition of his "distinguished services to astronomy."

M. BERNARD LYOT, of the Meudon Observatory, to whom the Gold Medal for 1939 of the Royal Astronomical Society has been awarded, will deliver the George Darwin Lecture before the society on May 12.

THE James Alfred Ewing Medal of the Institution of Civil Engineers has been awarded to Professor A. H. Gibson, professor of engineering in the University of Manchester.

THE James Scott Prize of the Royal Society of Edinburgh was presented to Professor P. A. M. Dirac, Lucasian professor of mathematics at the University of Cambridge, at a meeting of the society on February 6, when he delivered an address entitled "The Relation between Mathematics and Physics."

THE Cameron Prize of the University of Edinburgh for 1939, the value of which is about £200, has been awarded to Dr. Gerhard Domagk, of the Institute for Experimental Pathology and Bacteriology, I. G. Farbenindustrie, Elberfeld, Germany, "in recognition of his discoveries which initiated the treatment of diseases of bacterial origin by compounds belonging to the sulphonamide group."

DR. ALEXANDER SILVERMAN, head of the department of chemistry in the University of Pittsburgh, has been elected a member of the French Association of Scientific and Technical Ceramics.

THE University of Cincinnati Chapter of Sigma Xi has elected the following officers: *President,* Dr. Glenn E. Cullen, professor of biochemistry and director of laboratories of the Children's Hospital Research Foundation; *Vice-president,* Dr. Frederick O'Flaherty, director of the Leather Research Laboratory of the University of Cincinnati; *Secretary-treasurer,* Dr. Saul B. Arenson, professor of inorganic chemistry, University of Cincinnati.

DR. HAROLD PERCIVAL HIMSWORTH, deputy director of the Medical Unit at University College Hospital, has been appointed to the university chair of medicine, tenable at University College Hospital Medical School, University of London.

DR. C. D. DARLINGTON has been appointed to succeed Sir Daniel Hall as director of the John Innes Horticultural Institution, Merton.

DR. F. L. GOLLA, professor of the pathology of mental disorders at the University of London, has been appointed director of the new Burden Neurological Institute in the grounds of Stoke Park, near Bristol. The building comprises laboratories for biochemical, physiological and endocrinological research, together with two observation wards each containing ten beds. The institution will be opened by Sir Thomas Inskip early in May.

H. W. GRAHAM, general metallurgist of the Jones and Laughlin Steel Corporation, Pittsburgh, has been elected chairman of the executive committee of the Industrial Research Institute to succeed Robert B. Colgate, of New York. H. Earl Hoover, vice-president of The Hoover Company, Chicago, Ill., was elected vice-chairman. New members of the committee are: L. W. Wallace, of Chicago, Ill., director of engineering and research for the Crane Company, and F. W. Blair, of Ivorydale, Ohio, chemical director of the Procter and Gamble Company.

DR. GEORGE C. SHATTUCK, clinical professor of tropical medicine at the Harvard Medical School, has

been reelected president of the Massachusetts Health Council.

DR. GEORGE D. OBERLE, formerly an agent for the U. S. Department of Agriculture, has been appointed associate in research in pomology at the New York State Agricultural Experiment Station at Geneva.

THE Committee on Scientific Research of the American Medical Association has made a grant to Dr. George Herrmann, of the Medical School of the University of Texas, for continuation of his study of the physical and chemical changes in heart muscle under varying experimental conditions, and to Dr. Charles Weiss, director of the Research Laboratories of the Mount Zion Hospital, San Francisco, to permit him to continue his researches on the immunology of staphylococcus infections.

DR. PHILIP C. JEANS, professor of pediatrics at the College of Medicine of the State University of Iowa, has received a grant of $7,500 from the Borden Company for the continuation of his investigations in infant nutrition. This grant was made available through the Council for Pediatric Research of the American Academy of Pediatrics.

PROFESSOR C. L. SHEAR, who retired in 1935 as principal pathologist in charge of mycology and disease survey of the Bureau of Animal Industry at Washington, is spending three months at the Citrus Experiment Station of the University of California working on the classification of fungi.

DR. ERNEST E. IRONS, formerly dean of the Rush Medical College of Chicago, and Dr. Peter Bassoe, professor of neurology, lectured recently at the School of Tropical Medicine at San Juan, Puerto Rico.

THE John Howard Appleton lecture at Brown University will be given on March 25 at 8:15 P.M. by Dr. J. E. Lennard-Jones, professor of theoretical chemistry at the University of Cambridge and fellow of Corpus Christi College. He will speak on "The Structure of Liquids."

DR. STEPHEN W. RANSON, director of the Neurological Research Institute of the Medical School of Northwestern University, gave the Charles R. Bardeen Memorial Lecture at the University of Wisconsin on February 8.

DR. CARL D. ANDERSON, associate professor of physics at the California Institute of Technology at Pasadena, gave a Sigma Xi address at the Louisiana State University on March 13. His subject was "Cosmic Rays and New Elementary Particles of Matter."

SIR ALDO CASTELLANI, visiting professor of preventive medicine and public health at the School of Medicine of the Louisiana State University, gave two lectures before the students and faculty of the School of Medicine of Yale University on February 28. He discussed "Medical Organization in Tropical Expeditions" and "Mycetes and Mycoses."

PROFESSOR S. LEFSCHETZ has returned from a trip to Belgium, where he lectured on general topics of topology and algebraic geometry, under the auspices of the Belgium American Educational Foundation, at the Universities of Brussels, Ghent, Liège and Louvain.

DR. R. B. STOLTZ, chairman of the department of dairy technology of the Ohio State University, lectured on March 9 before the Lancaster Branch of the American Association for the Advancement of Science. The lecture was entitled "Dairying Down Under" and was illustrated by colored motion pictures and slides of Australia and New Zealand.

A SYMPOSIUM on "The Social Function of Science" was given on the evening of March 10 at a meeting at the American Museum of Natural History of the New York Chapter of the American Association of Scientific Workers. The speakers were: Dr. Franz Boas, professor emeritus of anthropology, and Walter Rautenstrauch, professor of mechanical engineering, both of Columbia University; Dr. Morris Meister, principal of the Bronx High School of Science, and Dr. Vilhjalmur Stefansson, the Polar explorer.

A SERIES of summer conferences on astronomy will be held at the Harvard College Observatory from July 5 to August 15. The program will include courses on stellar astronomy and the following seminars: "Survey of Modern Problems in Celestial Mechanics," "Stellar Structure and Stellar Variability," "Hollow Square Conferences," "Conferences on Special Problems," "Distribution and Motions of the Stars." There will also be opportunities for research under guidance in the fields of stellar statistics, astrophysics, eclipsing binaries and photoelectric photometry. In addition to members of the faculty, the following visiting lecturers will take part in the conferences: Dr. Svein Rosseland, of the Institute of Theoretical Astrophysics, Oslo; Dr. Jan Oort, of the University Observatory, Leyden; Dr. Freeman D. Miller, of Denison University; Dr. Zdenek Kopal, of the University of Prague; Dr. Richard A. Prager, of Berlin, and Dr. E. F. Freundlich, of Prague.

THE eighteenth International Congress of Anthropology and Prehistoric Archeology and the eighth session of the International Institute of Anthropology will be held at Istanbul, Turkey, from September 18 to 25. The general secretary for the congress is Professor Muzaffer Göker, dean of the faculty of languages, history and geography at Ankara, Turkey.

THE Museums Association of Great Britain will hold its fiftieth annual meeting from July 3 to 8 at Cheltenham. The council of the association has invited the American Association of Museums to be officially represented at this meeting. Members of the American association who may be able to attend are requested to communicate with the president or the director. Among the speakers at the meeting will be Lord Amulree, president of the Royal Society of Arts; Sir Robert Witt, chairman of the National Art Collections Fund; Sir Evan Charteris, chairman of the Standing Commission on Museums and Galleries; Arundell Esdaile, president of the Library Association; and E. Foundoukidis, secretary-general of the International Museums Office. Entertainment will include a reception by the mayor of Cheltenham; a reception by Viscount Bledisloe, president of the Museums Association, and Lady Bledisloe; an association reception and dance; and excursions to the Cotswolds on July 7 and to other places of interest near Cheltenham on July 8.

THE twenty-second annual Canadian chemical convention will be held this year in London, Ontario, from June 5 to 8. T. A. Faust, president of Yocum-Faust, Ltd., is the chairman of the local committee, with J. A. Gunton, head of the department of chemistry, University of Western Ontario, as vice-chairman. There will also be meetings of the Industrial and Engineering Section, the Pure Chemistry Section, the Biochemical and the Agricultural Chemistry Section, the Food and Cereal Section and the Chemical Education Section of the American Chemical Society. A new section, Metallurgy and Mining, will be inaugurated. Special attention will be given to a discussion of the possibilities of the wider and better utilization of agricultural products for chemical and industrial purposes, in line with the recently established Chemurgic Council of the Canadian Chamber of Commerce.

ACCORDING to the *Journal* of the American Medical Association property valued at nearly a million dollars was recently given to the City of Atlanta by Dr. Luther C. Fischer, including the Crawford W. Long Memorial Hospital, established in 1908 by Dr. Fischer and the late Dr. Edward C. Davis. Dr. Fischer gave also his 138-acre estate in Chamblee to the same board of trustees, who will handle the hospital for the public. Ten acres of the estate are planted in roses; the gardens are endowed with $200,000 for maintenance. Dr. Fischer stipulated that the hospital must be operated for the benefit of families of modest means, those who are unable to pay the standard costs of hospitalization and unwilling to accept charity, but who will pay what they are able.

THE Rockefeller Foundation has appropriated £650 as a grant to the Cavendish Laboratory for the purchase of instruments and for assistance in connection with researches carried out by the Cavendish professor of experimental physics on the application of x-ray technique to the study of crystals of biological importance.

THE House Appropriations Committee recommended on March 8 the sum of $160,578,905 to finance the work of the Department of the Interior, including the Reclamation Service, the Indian Service, the National Parks maintenance, the Geological Survey and the Office of Education. An increase of $35,000 was recommended for the Bureau of Mines to permit it to carry on experimental and research work in connection with the production of metallic magnesium on the ground that it is valuable for aircraft construction. Some of the principal items in the bill included $50,622,600 for the Reclamation Service, $3,293,000 for the Geological Survey, $2,325,760 for the Bureau of Mines, $20,434,282 for the National Park Service, $16,264,100 for vocational education and $34,132,003 for the Bureau of Indian Affairs. Among other items in the bill is an appropriation of $1,070,000 for the Government-owned reindeer industry in Alaska.

THE Carnegie Corporation of New York has made a gift to the American Association of Museums to provide grants-in-aid for foreign travel and study during the year 1939 by members of the staffs of museums: whose principal duties are of a professional nature; whose salary is not over $3,000; who have not the private means to travel abroad; whose duties in their museums would not normally give them such opportunities; and to whom their institutions will give at least two months' leave on full pay for the travel for which the grant is made. These grants are for traveling expenses to places where the applicant will have an opportunity to broaden his background by familiarizing himself with the institutions, collections or regions of importance in the study of his particular professional subjects. It is planned that the average grant will not exceed $500 except under most unusual circumstances, and that it will not amount to as much as $1,000 in any case. All applications should be sent to the director of the American Association of Museums, Smithsonian Institution, Washington, D. C., before April 15.

THE Westinghouse Electric and Manufacturing Company has agreed to provide support for the science and engineering clubs of the American Institute of the City of New York for three years. The clubs provide an opportunity for young persons of high-school age to take part in scientific work.

DISCUSSION

SAFEGUARDING TYPE SPECIMENS

WITH two serious wars actually in progress in the world and constant threats of others, it is surprising that no general organized efforts have been made to safeguard the irreplaceable type specimens on which botanical nomenclature rests. This is a serious reflection on the breadth of vision of those engaged in systematic botany.

The importance of type specimens in taxonomy is now recognized by all competent systematists. Yet the care of these specimens is entrusted to any herbarium, large or small, in whose possession they happen to be. This is bad enough in the United States, where many institutions are not fully equipped for proper care of valuable material, but it is a crime against botanical science in those countries of the world where wars are being fought or constantly threatened.

With no intention of belittling the valiant efforts of those who have hidden the Spanish herbaria in cellars or of the British institutions which, during the world war, transported valuable specimens to country districts, and which were prepared to do the same during the recent crisis, it seems appropriate to ask why such uncertain measures must be necessary. Material is inevitably damaged during emergency packing and transportation, and in some institutions the task might seem so great as not to be attempted.

Scientists have no right to criticize the common people for having an apathetic attitude toward such important questions as national policies or to hold governments to account for the state of world politics, when their own inertia and provincialism stand in the way of solution of a problem as simple as that under discussion. The safeguarding of the specimens on which scientific language is based is an infinitely easier task than keeping nations out of war.

In the November issue of the *Journal of Botany, British and Foreign,* the writer has presented as a basis for discussion a plan for the preservation of all botanical types. It seems unnecessary here to more than summarize the features of this plan and to call the attention of American botanists to it. Most of those interested doubtless have access to the *Journal of Botany.*

It is suggested that a central herbarium be established for the housing of all types and historically important specimens, in a locality selected as most unlikely to see any future war activity, remote from any possible military objective. Here type specimens could be deposited by all herbaria as gifts, permanent loans or, where loans are forbidden, by establishment in the central repository of an actual branch of the herbarium concerned. Administration would be in the hands of a director and board of regents appointed by the International Congress of Botanists. Loans of specimens would be made freely to accredited institutions. Financing would, at first, necessarily be by assistance of various research foundations and botanical institutions. Gradually an endowment could be built up, and service to the botanical public be expanded. The main immediate objective would be to get all type specimens into a safe, yet accessible place.

Who knows what has become of the young Chinese herbaria, as yet, fortunately, without many types? Who can not imagine what might have happened if the recent European trouble had burst into war? Prague, Berlin, Vienna, Paris and London would certainly have been bombed. The belief has recently been expressed that no nation would waste a bomb on a museum, that any damage would be due to accidents. However, reports have been coming from reliable sources that many important Chinese educational institutions have been systematically destroyed. And the university at Madrid was used as a fortress. Military men should not be the only ones to learn lessons from these "rehearsals."

Types and other historic specimens can no longer be regarded as private property of individuals or institutions, but must be treated as a legacy, entrusted to us by the botanists of the past for the benefit of botanical science, present and future.

Certainly these considerations are important enough to merit discussion. It is to be hoped, too, that nationalism, institutional jealousy and the desire for institutional prestige may, for once, be entirely absent from the discussions. Local discussion is urged on this problem during the next year and a half, with a view to definite action at the congress at Stockholm in 1940.

F. R. FOSBERG

BOTANY DEPARTMENT,
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AN UNCOMMON METHOD FOR THE DETERMINATION OF "g"

AMONG the numerous possibilities of determining the gravitational acceleration g, one has found little or no attention. To the writer's knowledge none of the regular physics practica makes use of the conical pendulum for the determination of g, although this constitutes a very instructive experiment with a simple underlying theory.

For the conical pendulum, moving around a vertical axis, an equilibrium exists between the centrifugal force and the gravitational force. It is

$$(1)\quad mg = ml\omega^2\cos\alpha$$

where m is the mass of the pendulum, l its length, α the angle which the suspension forms with the axis, and $\omega = 2\pi n$, with n as the number of revolutions per second with which the pendulum rotates. One can substitute

$l \cos\alpha = h$, where h is the vertical distance between the suspension point of the pendulum and its center of gravity. This results in

$$(2)\quad g = h\omega^2 = 4\pi^2 n^2 h$$

All that is necessary to perform the experiment is a motor with adjustable speed with the turning axis in vertical position. From the axis a little weight is suspended by a string. Furthermore, a revolution counter has to be attached to the axis. The speed of the motor is adjusted so that the weight swings in a predetermined height h, which can be observed through a telescope, and which is kept constant. Then only the number of revolutions has to be determined over a given period of time. Even with a rather crude set-up reasonable accuracy is readily attainable. If a kathetometer is used for the height determination and a revolution count made over a longer period of time a rather good approximation of g may be obtained.

The method can be refined by controlling the height of the weight and the speed of the motor by a photoelectric cell and by placing the arrangement in a vacuum.

H. LANDSBERG

THE PENNSYLVANIA STATE COLLEGE

FOREIGN JOURNALS IN THE U.S.S.R.

IN a note in your issue of December 6, 1935, I compared the numbers of three British journals going to the U.S.A. and the U.S.S.R., respectively. In spite of the reiterated claim that scientific persons are treated more liberally in the U.S.S.R. than in any other country, and that the Soviet Union leads the world in its expenditure on and attachment to science, it appeared that in the United States *government and private effort together* obtained nine times as many copies of three important foreign scientific journals as in the Soviet Union.

It is possible that this comment did some good, for in the meantime the ratio has fallen from 9 to 4. Improvement is still necessary, for science can not be prosecuted without knowledge of what other people are doing, and the Soviet Union should need at least as many foreign journals as the U.S.A., since personal contact of its workers with foreign scientists is impossible. If the ratio (purchases by U.S.S.R.)/(purchases by U.S.A.) rises uniformly with time, it will become unity in about 1956. By then also it may be possible for scientific research workers in the U.S.S.R. to visit their colleagues in other countries. At present apparently it is not possible, for in spite of the evident attachment of the Soviet Union to physiology—not one physiologist was permitted to attend the International Congress of Physiologists last summer, nor even to answer the invitation.

Table 1, however, gives one hope of better things:

TABLE 1

	U.S.S.R.	U.S.A.	Ratio: per cent.
November, 1935			
Journal of Physiology	27	241	11.2
Journal of Experimental Biology	7	130	5.4
Biochemical Journal	47	374	12.6
Total	**81**	**745**	**11.9**
February, 1939			
Journal of Physiology	52	268	19.4
Journal of Experimental Biology	27	136	19.9
Biochemical Journal	126	390	32.3
Proceedings of the Royal Society A	25	191	13.1
Proceedings of the Royal Society B	15	146	10.3
Total	**245**	**1,131**	**21.6**

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THE MANIFESTO BY A PHYSICIST

No one can read Professor Bridgman's "Manifesto by a Physicist" in the February 24 issue of SCIENCE without being profoundly impressed by the sincerity and high purpose of the author. Nor will any one doubt that his decision to close his laboratory to citizens of totalitarian states was taken "only after the gravest consideration."

One hesitates to call in question the carefully considered action of one of the most distinguished ornaments of American science, a man internationally known not only for his contributions to physics but also for his writings on the philosophy of science. Nevertheless, I venture to express the hope that few scientists in America and other democratic countries will follow Professor Bridgman's lead. I do this because of serious doubts respecting the efficacy of the procedure, its propriety, its justice and its wisdom.

It is difficult to see how such demonstration of hostility to the totalitarian conception of the state and the place of science in the state can be effective of great good. The detestation of democratic peoples for totalitarian ideas has long been proclaimed from the housetop. To express it in the laboratory can not add greatly to the weight of public opinion marshalled against the totalitarian régimes. Humiliation of visiting scientists, especially when it is visited upon the innocent as well as the guilty, must breed resentment against the behavior of scientists in the democracies.

Would not envy of them be more productive of action in the direction we wish? The scientist from Germany, Italy, Russia or Japan who visits our laboratories and observes the freedom in which we work can not but compare our liberty of action with the strait-jacket into which his government has put him, his colleagues and his students. Will not such visitor return to his land a more effective missionary for human liberty than one who has encountered only humiliating rebuffs?

The propriety of excluding visitors from scientific laboratories and other spheres of scientific activity, solely on the ground of citizenship in a totalitarian

state, seems open to question. It is not in the tradition of science to make political, economic or religious beliefs and behavior a test for entrance into scientific cooperation. One of our chief indictments against the totalitarian states is that they have degraded science by subordinating their laboratories and their lecture halls to political control and to political uses. Can we then with propriety open or close our laboratories and our lecture halls for political purposes, even when those purposes to us seem meritorious? Is there not, on the contrary, a fundamental impropriety in mixing politics with science, whether this be done in a totalitarian or a democratic state?

It is difficult to see how visitors can be excluded from our scientific laboratories, *solely on the basis of citizenship in a totalitarian state,* without perpetrating frequent and serious injustice. It will be noted that the views of the individual visitor are not the subject of attack. It is the policies of his country that are to be punished in his person. From personal acquaintance with scientists in all the totalitarian states I can testify that by no means all of them are active exponents or even willing victims of totalitarian ideologies. Some I know, and many more I believe, both hate and fear the governments they are forced to serve. Not all can emigrate, and when home and family may be involved in ruin, it is not easy to avow one's beliefs and become a martyr to one's principles.

To exclude such men from the fraternity of science solely on the basis of their citizenship is to punish the innocent for the crimes of the guilty. The plea that only thus can we bring pressure to bear upon the guilty does not sufficiently commend the procedure. When Germany delivered innocent Jews to massacre and pillage because some Jew in a foreign land had been guilty of assassinating a German official, the civilized world cried out in horror. Comparison between such inhuman slaughter and spoliation, and the relatively mild action of excluding citizens of totalitarian states from scientific laboratories, is admittedly remote. But the fundamental principle underlying both procedures was avowedly the same: to bring pressure upon those otherwise beyond effective reach, by punishing, regardless of their individual innocence or guilt, those whom circumstances place within our power.

There would be more justice in such action were the circumstances reversed and were scientists in the totalitarian states to exclude American visitors from their laboratories because the American government had adopted policies harmful to science. For in a democracy the citizens are responsible for the government they place in power. But who will pretend that citizens of the totalitarian states are responsible for the acts of their governments? When bullets replace ballots in government, the responsibility as well as the freedom of the citizen is extinguished.

Even were there a measure of justice in the proposal under discussion, the wisdom of such action would still remain in question. If it be right for scientists to close their laboratories to citizens of totalitarian states, it is right for editors of scientific journals to close their columns to contributors from such states. It is not easy to see why exclusion from the lecture-room and the seminar should not follow. This would put not only science but also our universities and other centers of research and teaching into the political arena for the purpose of combatting a system of government harmful to science. The object in view seems to me commendable; but is the method wise?

It may be argued that the act of exclusion is intended to keep politics, and particularly a bad political philosophy, out of science and out of the university: and Professor Bridgman was careful to say that his statement regarding exclusion was made in his capacity as an individual and that it had "no connection whatever with any policy of the university." As to the first point, publication of the exclusion policy in this country and abroad will almost certainly make the action a factor in international politics, especially if scientists generally follow Professor Bridgman's lead. Indeed, the essential reason for the action is to accomplish a political purpose: to help "make the citizens of the totalitarian states realize as vividly and as speedily as possible how the philosophy of their states impresses and affects the rest of the world." Surely science will find itself involved in a peculiarly angry type of international politics if scientists in large numbers restrict access to their laboratories, observation of their apparatus and discussion of their experiments, for the express purpose of accomplishing the objective quoted.

Such action must inevitably involve the university as well, unless the laboratory is the personal property of the scientist and located outside university grounds. The individual professor can not use university property (whether it be laboratory, lecture hall, stationery or official title) for political or other purposes without involving the university in his activities. This fact has long been recognized by university authorities, and is a common cause of restrictive administrative regulations. A given university may for various reasons approve a specific act of the kind under discussion, or may grant its officers wide latitude in the exercise of discretion. But the question remains: Is it wise for the university, the traditional home of intellectual liberty and untrammeled search for truth, to become involved in acts of exclusion designed to effect political ends?

To the writer it seems most unwise, even dangerous, to make university halls and scientific laboratories in any degree the base for political action. For sound reasons a scientist may bar this or that obnoxious individual from his classroom or his laboratory. But

the reasons should apply to the individual, not to a nation; and they should be such as would cause him to exclude an American as quickly as a German, an Italian or a Russian. Science itself is imperilled far more than is any hateful political system when those engaged in the search for truth utilize courses of scientific instruction, scientific laboratories or scientific journals as weapons in political warfare.

In closing let me emphasize the fact that what I have written is in no sense a plea for toleration of totalitarian ideology. I am not among those who believe that it is a Christian duty to regard with toleration things which are utterly intolerable. And surely nothing could be more intolerable than the enslavement of the human spirit practiced under the totalitarian form of government! What I have done is to record my plea that scientists fight political battles with political weapons, and that they do all within their power to keep our academic halls and research laboratories sheltered from political storms, safe havens of intellectual sanity, calm judgment and free search for truth in a world gone mad.

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SCIENTIFIC BOOKS

INSULIN

Insulin. Its Chemistry and Physiology. By HANS F. JENSEN. New York: The Commonwealth Fund. London: Oxford University Press. 1938. Pp. 252.

IT may be stated immediately that Dr. Jensen's book is an excellent one. More than ten thousand reports on insulin have been published since 1922, and an adequate study of this subject now touches upon many aspects of physiology and of protein chemistry. For this reason it is extremely difficult for one author adequately to cover all aspects of the subject, but Dr. Jensen has enlisted the aid of experts in physiological matters, and he, himself, is admirably suited to discuss the problem from the chemical view-point. By the same token, it is expedient for the reviewer to secure opinions from his colleagues who have worked along lines on which he is less competent to comment. One is happy to find that the chemists who have been consulted and who have first-hand knowledge in this field are very enthusiastic about Dr. Jensen's contribution.

In the first chapter an accurate and concise account of the history of insulin is given. In the second, the various methods for the preparation of the hormone are described, and a table showing the yields of insulin secured by the various procedures is given. Here it may be remarked that, as many of the reports express the yield in terms of some absolute unit, results can not be accepted at their face value. The general trend, however, is clear. The preparation and chemistry of crystalline insulin is then discussed. What would appear to be a mistake in a date will be found in the preface, where it is stated that crystalline insulin was prepared in the year 1922. The report of this work was, of course, published in 1926. The fourth chapter deals with the standardization of insulin and is very well handled; the fifth deals with its administration, and the sixth with substitutes for insulin. Here the author gives more prominence to "Duodenin" and "Incrétine" than the reviewer would be prepared to do. The author remarks that it is probable that "all these workers were dealing with the same substance in spite of differences noted in the effect on depancreatized animals." An equally probable interpretation is that none of the workers were dealing with any active substance. The last chapter deals with the physiological action of insulin and provides a very useful review of this phase of the subject.

It has not been possible in the space available in this book to discuss in a comprehensive manner all the aspects of the situation. One feels that this volume should provide an excellent text for students and that lectures on the chemistry and physiology of insulin could well be based on it. For some courses the book would be adequate, for others it would have to be supplemented by more detailed comments.

There are a few places in which the author has made an interpretation of the results which differs from that which the reviewer feels is correct. This merely means that there are still many problems associated with insulin which have not as yet been settled.

The book is well written, the pages are of a convenient size and the type is good. The bibliography and the author index have been, with a few exceptions, carefully prepared and add greatly to the value of the publication.

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MATHEMATICAL SNAPSHOTS

Mathematical Snapshots. By H. STEINHAUS. G. E. Stechert and Co., New York[1] (printed in Poland; profusely illustrated), $2.50.

THE only way to review this beautifully made book is to describe its rich and extraordinarily varied content in some detail. It is mathematical recreations at a new level of simplicity, interest and unusualness, somewhat reminiscent of Lucas at his best, but less formal. Each page has one or more excellent illustra-

[1] The Polish copyright date, pasted over, appears to be 1936.

tions, some in two colors, and a pair of colored spectacles is provided for use with the anaglyphs. The pocket also contains a colored self-folding dodecahedron and a set of cards for mathematical movies. Perhaps "visual mathematics" describes the general character of the recreations. Wisely, the author has refrained from attempting to teach anything, although any one who can turn the pages without learning something must be singularly stupid. As in all good recreations, the concealed mathematics sometimes lies very deep. In this sense the book is scientific. But it can be enjoyed by any one with a grammar-school education.

As the contents are so unusual, we give a partial summary of the topics touched so lightly and so effectively by the author (who, by the way, is a distinguished mathematician). We find: dissections of rectangles; noughts and crosses; the slide rule; chess problems, Euler's 36 officers, the 15 puzzle; musical scales; simple nomograms; the golden section, Fibonacci's sequence and phyllotaxis; tesselations; the triangle of forces; Peaucelier's linkage; anaglyphs; straight-edge constructions, roulettes, cams; Minkowski's lattice theorem; the limaçon, conics, the tractrix; space-filling curves; the regular solids, crystals, densest packing, soap-bubbles; orthodromes and loxodromes; ruled surfaces; the resolution of cusps on skew curves; topological problems—unicursal patterns, the bridges of Konigsberg, knots, Möbius' strip, existence of a bilateral surface with a knotted edge, the map problem for a torus; Pascal's triangle and the "board of fortune," the Gaussian distribution—amusingly illustrated by an experiment on digitalized frogs, which inspires the author to rechristen the normal curve "the frog-line"; the law of biologic growth, and finally, a somber mortality graph for the U. S. in 1910. Scholarly historical and mathematical notes (184) conclude this most fascinating book. It should perform a genuine service by popularizing mathematics.

E. T. BELL

SPECIAL ARTICLES

CHARACTERIZATION OF GONADOTROPIC HORMONES OF THE HYPOPHYSIS BY THEIR SUGAR AND GLUCOSAMINE CONTENT[1]

CHEMICAL purification of the anterior pituitary hormones has been impeded by their protein nature and by time-consuming bioassays. In the case of the gonadotropic hormones, the situation is further complicated by their established interrelations. Chemical differences in these hormones traced by quantitative analytical routine would naturally prove a boon in purification efforts. Thus the purification and crystallization of insulin speedily followed the discovery of the high sulfur content of this hormone.

It has recently been found[2, 3, 4] that gonadotropic preparations from the pituitary as well as from other sources are rich in *carbohydrate*. We therefore determined the carbohydrate content (orcine method) of the 40 per cent. alcohol extracts of acetone dried sheep pituitaries which served as our starting material, and of purified FSH and ICSH fractions prepared therefrom. The method of fractionation was based on salting-out procedures[5] and subsequent acid-acetone fractionation. When assayed in our hypophysectomized female rats the total M.E.D. of the best FSH and ICSH preparations was between 0.005 mg and 0.01 mg. The starting material contained about 9 per cent. carbohydrate. FSH fractions have a high carbohydrate content (10.3 to 13.1 per cent.) increasing with purification; ICSH fractions[6] a conspicuously lower carbohydrate content (5.4 to 3.6 per cent.), decreasing with purification. All other available hormone fractions from the pituitary showed a low carbohydrate content (see table 1). Although, as mentioned, FSH fractions have an increasing carbohydrate content with increasing purity, a high carbohydrate content in any pituitary fraction can not be taken as a measure of its FSH potency, for inert proteins isolated from FSH mother-liquors had a content of 19 per cent. carbohydrate.

In search for a more specific chemical characterization of gonadotropic hormones, *glucosamine* was determined by the Elson-Morgan method. Gonadotropic fractions contained more glucosamine than any other pituitary preparations investigated. Glucosamine increased with the increasing purification of both FSH and ICSH. The best FSH contained 8 per cent. glucosamine, ICSH 3.8 per cent., while inactive fractions contained approximately 3 per cent., thyrotropic hormone approximately 3 per cent., growth hormone 1.8 per cent. and lactogenic and adrenotropic no glucosamine. Thus glucosamine determination may well be taken as a measure of gonadotropic potency in pitui-

[1] Aided by grants from the Board of Research of the University of California and Rockefeller Foundation of New York.

[2] M. Hartman and F. Benz, *Nature*, 142: 115, 1938.

[3] G. Fleischer, E. Schwenk and K. Meyer, *ibid.*, 142: 835, 1938.

[4] S. Gurin, C. Bachman and D. W. Wilson, SCIENCE, 89: 62, 1939.

[5] H. Jensen, M. E. Simpson, S. Tolksdorf and H. M. Evans, *Jour. Biol. Chem.* (in press).

[6] Attention must be drawn to the very striking difference in the carbohydrate content of pituitary ICSH (3.6 per cent.) and of chorionic ICSH—that in pregnancy urine (ca 18 per cent.).

TABLE 1

Pituitary fractions	Carbohydrate, per cent.	Glucosamine, per cent.
40 per cent. Alcoholic Extract of Sheep Pituitary Powder	9.2	3.0
FSH		
(IF66A)	13.1	8.1
(IF18)	10.3	7.8
ICSH		
(L49B)	3.6	3.8
(L45DI)	5.4	5.8
Thyrotropic hormone		
(Schering)	2.9	3.5
(U89OK)	1.2	2.5
Growth hormone		
(DAP14)	2.7	1.8
Adrenotropic hormone		
(L16A4)	0.41	0
Lactogenic hormone		
(L16L4)	0.25	0
Inert globulins	3.6	2.7
Inert albumins	19.1	3.7

tary fractions and may prove a useful tool in the purification of these hormones. On the other hand, the absence of glucosamine in our adrenotropic and lactogenic preparations is important further evidence that gonadotropic hormones do not contaminate these preparations.

While from the foregoing it is evident that carbohydrate determinations alone will not differentiate gonadotropic from other pituitary fractions, they are extremely useful when employed in conjunction with glucosamine determinations. Thus, glucosamine content enables one to differentiate between gonadotropic and other fractions from the pituitary, while carbohydrate content gives the clue as to the particular gonadotropic fraction with which one may be dealing. Though future research may modify the values for either hormone, we can safely state that a glucosamine-rich pituitary fraction will be mainly FSH if it contains more than 12 per cent. carbohydrate, and mainly ICSH if it contains less than 4 per cent. of the latter.

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A SELECTIVE ACTION OF URINE AND SERUM FROM PATIENTS WITH MALIGNANT TUMORS ON EMBRYONAL AND NEWLY GROWING TISSUES

SOME two years ago there came for examination a young man of twenty-four, who had a tumor, a large embryonic cancer, of the right testicle. His urine, injected into a virgin rabbit, gave the characteristic Ascheim-Zondek reaction. The tumor was removed, and for about a month the reaction was absent. It then returned and with the appearance of metastases later on, the reaction became stronger. Being curious to see what effect this patient's urine would have on the ovaries, 20 cc were injected daily, intravenously, into a 12-day pregnant rabbit. On the fifth day the animal aborted. As this was unexpected, the urine was injected into three other pregnant rabbits, with the same result as in the first.

It was thought that the embryonic character of the tumor was the important factor, and accordingly urines of patients with tumors of corresponding types —dysgerminoma of the ovary, teratoma of the testicle and the Wilms tumor—were tested. These all produced abortion. The urines of a large number of patients with other types of malignant tumors were then tested, and in all instances abortion occurred, usually within a period of five days. Blood serum of patients whose urine had the abortifacient effect also was effective. As a control the urine or serum of a considerable number of normal individuals and ward patients free of malignancy was injected, with negative results.

The uterine changes which are produced are striking. With daily injections of the urine, there occurs, starting at the inner border of the decidual cells, a progressive placental necrosis associated with infiltration of inflammatory cells. The zone of necrosis becomes increasingly broadened until it involves the entire embryonal mass on the decidua. With the removal or absorption of the foetal structures, the uterus eventually returns to a normal state. The foetus in its early period undergoes rapid loss of its structural form. In late pregnancy it is expelled without marked change in its structure.

In addition to the action of the urine on the placenta and foetus other effects have been noted. When injected into non-pregnant rabbits, changes were found in the ovaries. These consisted of definite degeneration or destruction of the graafian follicles, especially in the granulosa cell portion, the ovaries finally becoming small and sclerotic. Further, when injected into male rabbits, the testicles showed degeneration or complete absence of the spermatogenic processes.

In some other experiments the urine was injected into rats which had been grafted with No. 256 Walker carcinoma. The usual course of such tumors is that after a certain period of growth, necrosis and sloughing occur, this beginning centrally and only gradually extending to the periphery. The process is not of a hemorrhagic nature but of a suppurating type. In the urine-treated rats a different picture was seen. Necrosis occurred, but, instead of beginning in the center of the tumor, began at the periphery and in-

volved not only the cancer cells but also the epithelium of the newly formed blood vessels.

It would seem, then, that the urine and serum of patients with malignant tumors have a selective destructive action on embryonal or newly growing tissue.

We have not had opportunity for intensive study of the substance responsible for the effects described. It is possibly related to hormone activity, but there is no hormonal action we are aware of which produces these effects. As has been stated, the urine originally used gave the Ascheim-Zondek reaction. That this special property was not concerned with the abortifacient action was shown by the lack of effectiveness of the urine of pregnant women which gave the reaction. In carrying this line of work further, massive doses (500 units daily) of anterior pituitary Antituitrin S together with estrogenic hormone (20.000 units) were injected into pregnant rabbits. Abortion did not occur.

Work is being continued on the many interesting problems which arise in connection with it.

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SPLITTING PROTEINS BY ULTRA-VIOLET LIGHT

THE experiments of Rideal and Mitchell[1] have shown that stearanilide $C_6H_5NHCO(CH_2)_{16}CH_3$ undergoes photolysis when exposed to light as a monomolecular film, giving anilin and stearic acid. The -NHCO- group is the common peptide linkage of proteins and at first sight one might expect the stearanilide experiment to apply directly to protein splitting; however, in the amino-acids the side-chain carrying the benzene ring or other light-absorbing groups, is attached through a CH_2 group to the α-carbon atom of the acid. This means that the absorbed light quanta must travel from the ring through two CH_2 groups before it may activate the NH_2 group and cause a reaction.

In testing the possibility of such a transfer of energy from the ring to the chain, the writer has prepared benzyl stearyl amine $C_6H_5CH_2NHCO(CH_2)_{16}CH_3$, and β-phenyl-ethyl stearyl amine $C_6H_5(CH_2)_2NHCO(CH_2)_{16}CH_3$ and subjected mono-layers of each on N/1 hydrochloric acid solution to ultra-violet light of wavelength 2480 and 2537 Å, through filters. Photolysis of each compound is easily demonstrated in the properties of the film and by the reaction products. It is therefore to be expected that the peptide chains of proteins may be split at places where light-absorbing side-chains occur in the molecule. By irradiating a protein with a suitable wave-length of light, splitting can presumably be directed to points in the peptide chain adjacent to a side-chain carrying a given light-absorbing group. Svedberg and Brohult[2] have recently reported the splitting of haemocyanin by light in the region of the absorption band around 2750 Å.

The above-mentioned experiments are not to be confused with the photolysis of amino-acids in general which give ammonia and the corresponding hydroxy-acid.

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VITAMIN B_1 IN CEREBROSPINAL FLUID

THE vitamin B_1 (aneurin, thiamin) content of cerebrospinal fluid has not heretofore been reported. W. Karrer was unable to detect aneurin in this fluid, using the thiochrome reaction of Jansen.[1] However, we have obtained positive results in most of the fluids examined by adopting a slight modification of Westenbrink's technique for urine.[2] The values encountered in 30 cases belonging to various mental diseases (epilepsia, dementia praecox, paraphrenia) averaged 2.5 γ per cent. The technique employed was briefly as follows: the sample was acidified to pH 4.0 with acetic acid and adsorbed on frankonite. The adsorbate was washed and dried at 100° C. The powder was divided in two portions. Graduated amounts of one portion were added to a series of test-tubes containing synthetic media which were then sowed with fresh spores of *Phycomyces blakesleeanus* and determined by the method of Schopfer and Jung.[3] The other portion was eluated and oxidized with potassium ferricyanide and the thiochrome extracted with isobutanol. The fluorescence obtained was compared with a standard under ultra-violet light in a Zeiss photometer. The Phycomyces test showed higher values than the thiochrome test. In all cases in which the chemical test was negative, it was possible to detect the vitamin with the Phycomyces test. The cerebrospinal fluids were kindly sent to us by Dr. H. Linhares, of the Psychiatric Institute of the School of Medicine.

All the tests were made with 10 to 15 cc of fluid. Two cases (catatonia and depressive state) showed the highest values, but in other cases (myxedema with cretinism and epilepsy with dementia) no trace of aneurin could be found by either test.

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[1] *Proc. Roy. Soc. London*, 159: 206, 1937.

[2] *Nature*, 142, 830, 1938.

[1] W. Karrer, *Helv. Chim. Acta*, 20: 1147–1155, 1937.

[2] W. G. K. Westenbrink and J. Goudsmit, *Arch. Néerl. Physiol.*, 23: 79–96, 1938.

[3] W. H. Schopfer and A. Jung, *Zeit. Vitaminforsch.*, 7: 143–152, 1938; and G. G. Villela, O Hospital, 13: 43, 1938.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW DISSECTING APPLIANCE

LAST fall I found one of my comparative anatomy students (name withheld by request) using a very simple and convenient device for holding his dogfish open while dissecting. It consisted merely of an elastic band with a bent pin attached to each end, making it possible to attach one hook, carry the band around the dorsal side of the animal and hook it to the cut flap of the body wall on the other side. With a little improvement I am offering the idea to the readers of SCIENCE as a convenient and inexpensive dissecting device.

With a small pair of round-nosed pliers the head end of a common brass pin can be bent into a loop and closed over one end of an elastic band. Half an inch of the pointed end is then bent into a hook and with a second pin at the other end the device is complete. Three or four hooks may be attached to a large elastic band if desired or bands may be tied or looped together. The sketch, Fig. 1, shows how it is made.

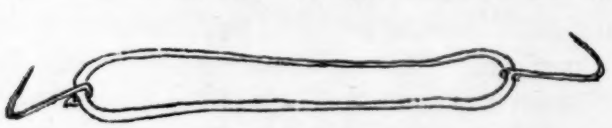

FIG. 1

Pins may be had up to 1½ inches in length or wire from paper clips may be used if large rubber bands are wanted.

The elasticity of rubber makes it particularly useful in holding back the cut flaps of the body wall while working and I like it much better than the chain hooks that are sold for the purpose. It can also be used to hold the body together when the animal is put back into the formalin tub, for if brass pins are used they will not rust.

PHILIP H. POPE

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SATISFACTORY SUBSTITUTE FOR SODA LIME IN RESPIRATION CALORIMETRY

IN a long experience with soda lime as an absorbent for CO_2, in respiration calorimetry, this laboratory never succeeded in permanently solving the practical problem of obtaining this preparation in satisfactory quality, the difficulty having been to get a product of uniformly high efficiency and one in which saturation with CO_2, and the coincident drying of the soda lime, would cause a definite change in color of the material. The results have been much waste of time and of soda lime, uncertainty of mind on the part of the worker and occasionally inaccurate results. This experience has been a common one in other laboratories.

A year ago the author suggested a substitute for soda lime which proves to have very much greater capacity to absorb CO_2, which changes color conspicuously as it comes to be exhausted and which is cheap and reliable.

This preparation is a 40 to 60 mixture of flake sodium hydroxide and granular pumice stone. It is important in the use of this absorbent, in a Schwartz U tube, to fill the hollow of the stopper of the stopcock on the incoming side with wet absorbent cotton.

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A METHOD FOR OBTAINING A CONTINUOUS MEASUREMENT OF SOIL MOISTURE UNDER FIELD CONDITIONS

A METHOD has been devised for making *in situ* under field conditions a continuous measurement of soil moisture. It consists of imbedding in the soil a standardized block of $CaSO_4$ (gypsum). The moisture content of this material varies directly with that of the soil. Since the dielectric constant of gypsum is proportional to its moisture content, a measure of the conductivity of the block is a measure of soil moisture. Conductivity determinations are easily made by means of electrodes and a form of the Wheatstone bridge.

This device measures soil moisture ranging from the wilting point to the field capacity or it is really a measure of the available water. It denotes the wilting point accurately. By knowing the wilting point and the available water, the total water content is thereby also known. The method possesses a surprisingly high degree of accuracy.

GEO. J. BOUYOUCOS
A. H. MICK

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BOOKS RECEIVED

ALLEN, VICTOR T. *This Earth of Ours.* Pp. xvii + 364. 258 figures. Bruce. $3.50.

DANTZIG, TOBIAS. *Number, the Language of Science.* Third edition. Pp. x + 320. Illustrated. Macmillan. $3.00.

DAVY, J. BURTT and A. C. HOYLE, Editors. *Check-Lists of the Forest Trees and Shrubs of the British Empire: No. 4, Draft of First Descriptive Check-List for Ceylon. January, 1939.* Pp. 115. Imperial Forestry Institute, Oxford.

ROLLEFSON, GERHARD K. and MILTON BURTON. *Photochemistry and the Mechanism of Chemical Reactions.* Pp. xiv + 445. 59 figures. Prentice-Hall. $5.75.

Texas Agricultural Experiment Station; Fiftieth Annual Report, 1937. Pp. 321. Agricultural and Mechanical College, College Station.